

## Minds-On Organic Chemistry

**Purpose:** Throughout this unit, students have the opportunity to “build” molecules from the different classes of organic compounds in a fun and hands-on way.

There are a variety of ways in which to frame this activity. During the beginning of the unit, students can build the molecule from the given IUPAC name, as a way to practice nomenclature or structure. At the end of the unit, it can be a tactile strategy to practice manipulating the different reactions relating to organic chemistry.

### Example Activity: Mystery Organic Molecule

**Purpose:** To become familiar with the unique structures of different classes of organic compounds

**Materials:** Large marshmallows, coloured marshmallows, toothpicks, Ziplock bags

Large marshmallows (carbons)

Small white marshmallows (hydrogens)

Small green marshmallows (nitrogens)

Small pink marshmallows (oxygen)

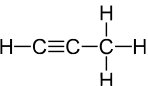

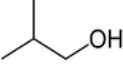
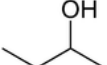

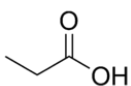
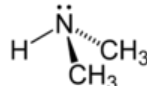
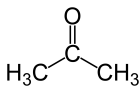
**Method:** Arrange bags with the exact number of marshmallows (atoms) and toothpicks (bonds) to construct the compounds below. Each group of 3-4 students will get a different bag, instructions, and discussion questions. After 10 minutes, groups will select a presenter to share their compound, process, and answers with the class.

#### **Instructions:**

*In this bag, you have exactly enough marshmallows (atoms) to construct a compound from this class of organic compounds: **alkyne / alcohol / carboxylic acid / secondary amine / ketone**. You must use ALL marshmallows. Please answer the following questions:*

1. *What is the proper IUPAC name for your compound?*
2. *What are the isomers that can exist for the same chemical formula, or is this the only way that this chemical formula can be represented?*
3. *What is the general formula for this class of compounds?*
4. *What are the major applications of this class of compounds in society?*

#### **Answers:**

Bag #1	Bag #2	Bag #3	Bag #4	Bag #5
 Propyne $C_3H_4$	<b>Butanol</b> - any of the four <b>isomeric alcohols</b> of formula $C_4H_9OH$ : <i>n</i> -Butanol, 1-butanol  Isobutanol  <i>sec</i> -Butanol, 2-butanol  <i>tert</i> -Butanol, 2-methylpropan-2-ol 	 Propanoic acid $CH_3CH_2COOH$	 Dimethylamine $(CH_3)_2NH$	 Propanone or acetone $C_3H_6O$
$C_nH_{2n-2}$ Alkyne	$C_nH_{2n+1}OH$ Alcohol	$C_nH_{2n+1}COOH$ Carboxylic Acid	$C_nH_{2n+1}NH$ 2° Amine	$C_nH_{2n}O$ Ketone
Naturally occurring gasoline, oil sands in Alberta	Beverages, solvents, antiseptic	Food (acetic acid), production of polymers, solvents, food additives	Dyes; drugs designed to mimic/interfere with the action of natural amine neurotransmitters	Solvents, polymer precursors, pharmaceuticals

In this bag, you have exactly enough marshmallows (atoms) to construct a compound from this class of organic compounds: **alkyne**.  
You must use ALL marshmallows.

**Please answer the following questions:**

1. *What is the proper IUPAC name for your compound?*
2. *What are the isomers that can exist for the same chemical formula, or is this the only way that this chemical formula can be represented?*
3. *What is the general formula for this class of compounds?*
4. *What are the major applications of this class of compounds in society?*

In this bag, you have exactly enough marshmallows (atoms) to construct a compound from this class of organic compounds: **alcohol**.  
You must use ALL marshmallows.

**Please answer the following questions:**

1. *What is the proper IUPAC name for your compound?*
2. *What are the isomers that can exist for the same chemical formula, or is this the only way that this chemical formula can be represented?*
3. *What is the general formula for this class of compounds?*
4. *What are the major applications of this class of compounds in society?*

In this bag, you have exactly enough marshmallows (atoms) to construct a compound from this class of organic compounds: **carboxylic acid**.  
You must use ALL marshmallows.

**Please answer the following questions:**

1. *What is the proper IUPAC name for your compound?*
2. *What are the isomers that can exist for the same chemical formula, or is this the only way that this chemical formula can be represented?*
3. *What is the general formula for this class of compounds?*
4. *What are the major applications of this class of compounds in society?*

In this bag, you have exactly enough marshmallows (atoms) to construct a compound from this class of organic compounds: **secondary amine**.  
You must use ALL marshmallows.

**Please answer the following questions:**

1. *What is the proper IUPAC name for your compound?*
2. *What are the isomers that can exist for the same chemical formula, or is this the only way that this chemical formula can be represented?*
3. *What is the general formula for this class of compounds?*
4. *What are the major applications of this class of compounds in society?*

In this bag, you have exactly enough marshmallows (atoms) to construct a compound from this class of organic compounds: **ketone**.  
You must use ALL marshmallows.

**Please answer the following questions:**

1. *What is the proper IUPAC name for your compound?*
2. *What are the isomers that can exist for the same chemical formula, or is this the only way that this chemical formula can be represented?*
3. *What is the general formula for this class of compounds?*
4. *What are the major applications of this class of compounds in society?*